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# Proceedings of the Newfoundland and Labrador Regional Peer Review Process on the Status of Subarea (SA) 2 and Divisions 3KL Capelin and Divisions 3KL and Subdivision 3Ps Herring

**February 3-5, 2015**
**St. John's NL**

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**Foreword**

The purpose of these Proceedings is to document the activities and key discussions of the meeting. The Proceedings may include research recommendations, uncertainties, and the rationale for decisions made during the meeting. Proceedings may also document when data, analyses or interpretations were reviewed and rejected on scientific grounds, including the reason(s) for rejection. As such, interpretations and opinions presented in this report individually may be factually incorrect or misleading, but are included to record as faithfully as possible what was considered at the meeting. No statements are to be taken as reflecting the conclusions of the meeting unless they are clearly identified as such. Moreover, further review may result in a change of conclusions where additional information was identified as relevant to the topics being considered, but not available in the timeframe of the meeting. In the rare case when there are formal dissenting views, these are also archived as Annexes to the Proceedings.

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## SUMMARY

A meeting of the Newfoundland and Labrador Regional Peer Review Process on the status of Capelin (*Mallotus villosus*) and Herring (*Clupea harengus*) was held February 3-5, 2015, in St. John's, Newfoundland. Its purpose was to assess the stock status of Capelin in Northwest Atlantic Fisheries Organization (NAFO) Subarea (SA) 2 and Divisions 3K and 3L, and Herring in NAFO Divisions 3K, 3L and Subdivision 3Ps. This Proceedings document includes an abstract and summary of discussion for each presentation, as well as a list of research recommendations. The meeting terms of reference, agenda, and list of attendees are appended.

Participants at the meeting included staff from Fisheries and Oceans Canada (DFO) Science and Fisheries Management, and representatives from the Newfoundland and Labrador (NL) Department of Fisheries and Aquaculture, Memorial University of Newfoundland, and the fishing industry.

In addition to these proceedings, publications to be produced from the meeting include a Science Advisory Report and a comprehensive Research Document for each species, all to be available online on the DFO Canadian Science Advisory Secretariat Website.

**Compte rendu du processus régional d'examen par les pairs de Terre-Neuve-et-Labrador sur l'état du stock de capelan dans la sous-zone 2 et les divisions 3KL et l'état du stock de hareng dans les divisions 3KL et la sous-division 3Ps**

## SOMMAIRE

Une réunion du processus régional d'examen par les pairs de Terre-Neuve-et-Labrador sur l'état du stock de capelan (*Mallotus villosus*) et l'état du stock de hareng (*Clupea harengus*) s'est déroulée du 3 au 5 février 2015 à St. John's, à Terre-Neuve-et-Labrador. Son objectif était d'évaluer l'état du stock de capelan dans la sous-zone 2 et les divisions 3K et 3L de l'Organisation des pêches de l'Atlantique Nord-Ouest (OPANO), et l'état du stock de hareng dans les divisions 3K et 3L et la sous-division 3Ps de l'OPANO. Ce compte rendu comprend un résumé et un sommaire des discussions liées à chaque présentation, de même qu'une liste des recommandations relatives à la recherche. Le cadre de référence, l'ordre du jour et la liste des participants de la réunion sont joints.

Parmi les participants à la réunion, on retrouve des membres du personnel du secteur des Sciences du MPO et de la Gestion des pêches du ministère des Pêches et de l'Aquaculture de Terre-Neuve-et-Labrador, de l'Université Memorial à Terre-Neuve-et-Labrador et de l'industrie des pêches.

En plus du présent compte rendu, les publications à produire émanant de la réunion incluent un avis scientifique et un document de recherche exhaustif pour chaque espèce, qui sont tous disponibles en ligne sur le site Web du Secrétariat canadien de consultation scientifique du ministère des Pêches et des Océans.

# PHYSICAL AND BIOLOGICAL CONDITIONS IN NAFO SUB-AREAS 2-3, UPDATE FOR 2014

Presenter: G. Maillet

Contributions from E. Colbourne and P. Pepin

**Abstract**

The North Atlantic Oscillation (NAO) Index, a measure of the direction and intensity of the winter wind field patterns over the North Atlantic, returned to a positive phase in 2014. The positive phase is normally associated with strong arctic air outflow in the northwest Atlantic during the winter months. Sea ice extent increased substantially during winter 2014 with the first positive anomaly (higher-than-normal extent) observed in 16 years. Although sea-surface temperatures (SST) based on infrared satellite imagery remain above normal in most areas across the Newfoundland and Labrador (NL) Shelves in 2014, near surface measurements have declined subsequently from the record-high values observed in 2012. The annual signal in depth averaged water temperature at the inshore monitoring station (Station 27) was slightly below normal in 2014, a significant decrease from the record high in 2011. The cold-intermediate layer (CIL; volume of < 0°C) in 2014 was at its highest level since 1985 on the Grand Bank during the spring. Bottom water temperatures collected during the spring multi-species surveys in 2014 showed a substantial extent of CIL water on the Grand Bank with warmer temperatures along the slope, southeast Shoal, and deep water channels in 3Ps. The extent of Labrador Current-CIL Shelf water, based on CTD sub-surface and SST satellite measurements, shifted positive in 2014 for the first time since 1994.

The magnitude of the spring bloom derived from ocean colour imagery was well below normal in 2014 across the northwest Atlantic. In general, timing indices indicated delayed and shorter surface blooms in 2014. Water-column inventories of chlorophyll (proxy for phytoplankton biomass) increased slightly in 2014 from below normal conditions observed in recent years, consistent with satellite imagery. Trends in zooplankton biomass indicate a transition of small (< 1 mm) and large (> 1mm) size fractions occurred in 2007. Zooplankton biomass of < 1 mm small fraction declined while the large fraction increased and remained at relatively high levels through 2011. Peaks in the biomass of the large size fraction, which consists mainly of *Calanus* copepods, euphausiids, amphipods, and mysids, increased abruptly in 2007 and has remained above the long-term mean through 2014. Peaks in the biomass of the large size fraction coincided with higher standardized recruitment indices of capelin (DFO 2013). Studies investigating the production potential in large marine ecosystems suggest fish yields may be influenced by available primary and secondary productivity. Further work is ongoing to investigate these potential linkages.

The extent of the cold intermediate layer waters (CIL, < 0°C) is generally regarded as a robust index of ocean climate conditions off the eastern Canadian continental shelf. The CIL volume anomaly off the northeastern Newfoundland Shelf during fall has been below the long term (1981-2010) mean during the past 19 years but increased in 2014 for the first time since 1994 (Fig.1). Above normal extents of the CIL were pervasive throughout the mid-1980s and early 1990s and may be associated with later spawning and smaller sizes of capelin (Nakashima 1996).

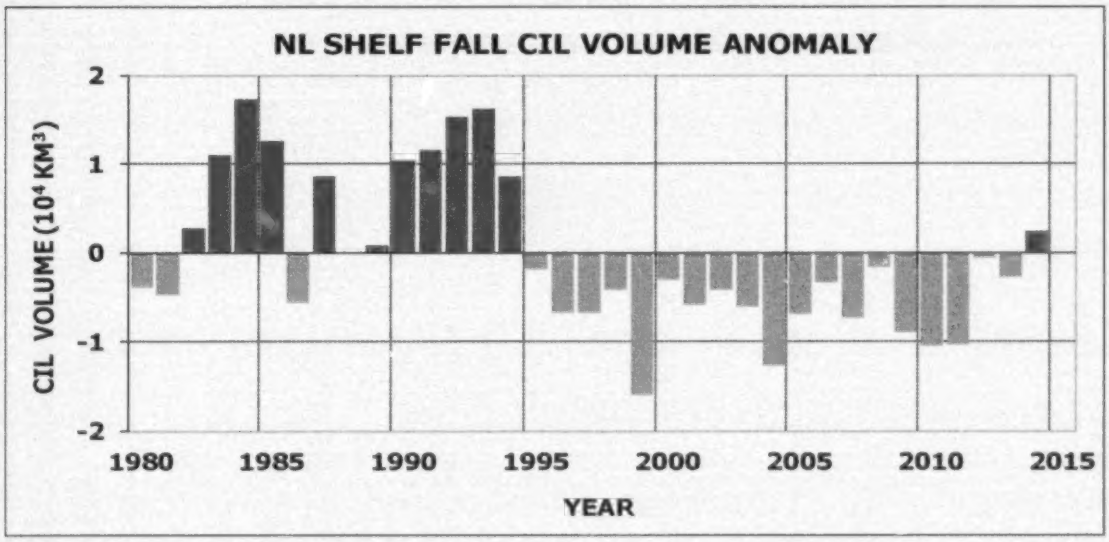


*Figure 1. Cold Intermediate Layer (CIL) volume anomaly off the Northeastern Newfoundland Shelf during the fall (1980-2010).*

Figure 2 illustrates the time series of composite anomalies in zooplankton biomass of small (< 1 mm) and large (> 1 mm) size fractions from NAFO Divs. 2J to 3LNO. The small size fraction would typically consist of small copepods, large ciliates, invertebrate larvae, and chain-forming diatoms along with larger dinoflagellates. The large size fraction would typically consist of calanoid copepods (*Calanus* spp.), euphausiids, amphipods, mysids, and larger invertebrate larvae along with gelatinous (e.g. salps, jellies) forms. Biomass of the small fraction peaked in 2002-06 but declined in 2007 and has remained below normal through to 2014. The reciprocal pattern was evident in the large size fraction with lower biomass the first-part of the time series but transitioning to higher biomass in 2007 and remaining relatively high through 2012. The biomass of the large size fraction has returned to near normal conditions in 2013--14. Increased biomass of the large size fraction of zooplankton may confer advantages to feeding in adult capelin due to the higher energetic content compared to smaller plankton. Peaks in the biomass of the large size fraction occurred in 2007 and 2011 which coincided with peaks in standardized recruitment indices of capelin (DFO 2013).

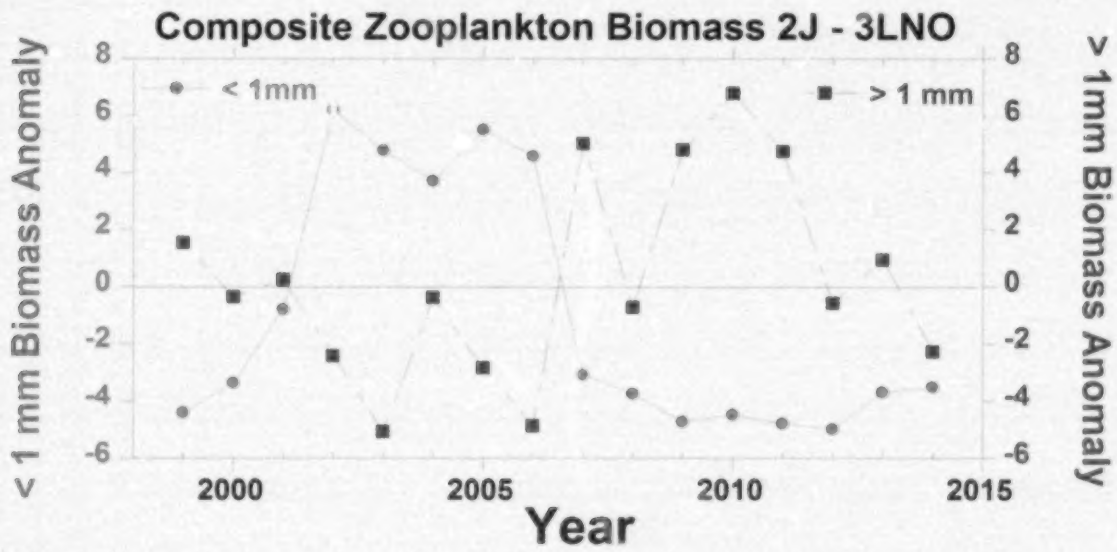


*Figure 2. Time series of composite anomalies in zooplankton biomass of small (< 1mm) and large (> 1mm) size fractions from NAFO Divisions 2J to 3LNO.*

**Discussion**

There was discussion in regards to whether the warming trend will continue or will we be going into a cold period in regards to sea surface temperatures. The multi-decadal index is shown to be at the peak of a warming period while the AMO composite climate index (larger scale index over the whole Atlantic) shows that it is going to continue warming. The current index indicates a warming regime with variability having mini cool periods. It was discussed how sea ice retreat may influence capelin biomass; information for 2014 is still being compiled. Paul Regular (DFO Science) quickly looked at the relationship between capelin abundance and the timing of retreat of sea ice and showed that the relationship in 2013 and 2014 was closer to that observed in the 1980s than in the last decade. The meaning of this is not yet known but looks positive. Questions were raised whether salinity was explored in regards to recruitment of capelin. For 2014, salinity still needs to be compiled but salinity is known to influence the incubation period and hatch of the larvae. The increase in large zooplankton and decrease in small zooplankton raised discussion although no concrete answer could be reached due to species not being distinguished at this time, however this will be done in the future.

## CAPELIN FISHERY AND DISTRIBUTION INFORMATION

Presenter: F. Mowbray

**Abstract**

The capelin fishery in 2013 and 2014 took 104 and 102 % of the 2J3KL quota respectively, although no landings occurred on the southern shore, northern Notre Dame Bay or Labrador. Capelin was landed in Conception Bay in 2014 for the first time since the mid-2000s. Sizes (lengths) of fish taken in the fishery in 3L and 3K were the highest since the early 1990s, largely due to an increase in the proportion of age 3 fish.

Information on capelin distribution was available from the spring (3L) acoustic survey and the spring (3LNO) and fall (2J3KLNO) multi-species surveys. Spring distributions shifted toward the

coast and southward in comparison to the last two decades. In 2014 spring multi-species surveys, capelin were also more widely observed in 3NO. It could not be ascertained whether these fish were part of the 2J3KL stock, and if so, why they were occurring so far south. One explanation discussed was the cold spring and unusually large extent of sea ice in spring 2014. Since 2011 capelin distribution in the fall surveys has been shifting north and west. Vertical distribution and movement of capelin remained attenuated in contrast to the 1980s, although capelin were occurring in shallower waters than during the last two decades.

**Discussion**

Industry commented on how they are seeing capelin in more areas. In 2013 and 2014 Conception Bay was able to catch almost the entire TAC which had not happened in several years. It is unknown whether this is due to the harvesters or the capelin. Also the capelin was observed to be bigger in weight and length than previous years. Capelin were observed further north in and around Labrador (2J); there is a small harvest amount in this area but not enough for a fishery. Discussion was raised on whether the stock in the Northern Gulf of St. Lawrence (4R) is overlapping with stocks in 3KL. This might be occurring but potentially in very small amounts due to different environments, however, it needs to be further explored.

Industry stated that capelin is very important to the harvesters that are involved in the NL fishery as it is an integral part of the viability of their enterprises. With the increase in size of capelin and favourable market conditions, they expect capelin to be an increasingly important part of fishing enterprises, and as such they support an increased effort placed on ensuring a healthy capelin stock for the future.

## CAPELIN BIOLOGICAL CHARACTERISTICS

Presenter: F. Mowbray

**Abstract**

Trends in the size of capelin taken in spring acoustic survey were not consistent across ages. Relative to the 1980s, younger fish have increased in size while older fish have decreased. In the last two years some improvement in the size of age 4 and 5 fish has occurred. Prior to 1992 the spring acoustic survey catch composition was largely dominated by age 2 fish, but from 1992-2013 has also included an increased proportion of age 3 fish. In 2014 the survey was once again dominated by age 2s. Much fewer of the age 2 (~20 %) capelin were maturing in 2014 when compared with the last two decades, when up to 80 % of age two fish were mature. Spawning in the last 5 years has shifted somewhat back toward the timing typical of the 1980s with spawning now occurring only 2 weeks later than it did then. Capelin diet is dominated by copepods in both the spring and fall and feeding success has varied among years. Spring feeding in 2014 was the one of the poorest in the series for all size classes.

**Discussion**

It was asked when assessing the age composition for capelin from the spring acoustic survey how many total capelin were processed to age. In each year 50 sets are conducted, on each set 40 capelin are processed resulting in approximately 2,000 per year.

## CAPELIN AUTUMN DIET

Presenter: D. Kamada

### Abstract

Previous research has shown that fall feeding by the capelin stock offshore of Newfoundland is key for survival of the population during the winter season (low food availability) and spring season (gonadal development). Characterization of the fall feeding diet of this stock has not been studied. Using the stomach content data from the Ecosystem Research Initiative multispecies survey (Fisheries and Oceans Canada), the inter-annual variability of fall diet for capelin is analyzed. A lower proportion of the high calorific euphausiids, copepods and hyperiids for the last years of the dataset were found to be significant. Consumption of larger prey items was higher in larger individuals as expected. Preliminary results suggest that during the fall, these main prey items range from ~80-90 % of the diet of capelin. Further work will focus on the relationship of capelin gut content in the fall zooplankton availability in the environment, hours of the day, temperature, and the relationship with population abundance estimates during the spring within the same time period.

### Discussion

Comments were made to further analyze using multivariate regression instead of the linear model approach, as the data are most likely violating the normal distribution assumptions. Discussion was made on what species would be more beneficial in the environment for the capelin to feed to be of better quality in the spring. Euphausiids are shown to have the highest caloric content therefore will be the most important prey in terms of energy. It was commented that the movements of the capelin and prey within the water column need to be explored, which will be addressed in the future through the Atlantic Zone Monitoring Program.

## CAPELIN ABUNDANCE

Presenter: F. Mowbray

### Abstract

The 2013 and 2014 abundance indices of capelin from the spring acoustic survey were the highest values since 1990 at 53.6 and 121.9 billion respectively; the 2014 value is about 25 % of peak values recorded in the 1980s. This increase in abundance corresponded to a decrease in the proportion of maturing age 2 fish and the presence of age 3 fish in the survey area.

### Discussion

There was discussion about environmental variables, such as timing of the start of sea ice retreat, and how this can help predict an increase or decrease in biomass through modelling in relation to the spring survey. It was asked if the effects of equipment changes and ship changes throughout the years are taken into account when looking at biomass. This is taken into account so therefore equipment should not create measurable bias.

## CAPELIN RECRUITMENT

Presenter: F. Mowbray

**Abstract**

Four recruitment indices covering the year classes since 2003 were generally coherent until 2012 but have since diverged. The most recent estimates of the 2012 and 2013 cohorts in the acoustics survey were both the highest since 1996. These cohorts are expected to comprise the majority of spawners in 2015 and 2016. Both larval indices of abundance for the 2014 cohort were below average. Other cohorts of similar magnitude have not contributed significantly to the maturing spawner biomass.

**Discussion**

There was a discussion about how recruitment for 2014 seems lower than other years, which might be of concern in the future as they only enter into the fishery at around age 2. Points were raised about Bellevue Beach and Trinity Bay being only a snapshot of all the places capelin spawn. Back in the 1980s surveys were done using multiple bays, Bellevue was shown to be a preferred habitat and it works as a good index to show the overall recruitment trend. A point was raised that when considering the recruitment indices, more quantitative analysis should be used to show more concrete support of increases or decreases in recruitment.

## CAPELIN PREDATORS AND CONSUMPTION

Presenter: N. Wells

**Abstract**

The structure of the ecosystem in NAFO Divisions 2J3KL has undergone significant changes since 1995. After the collapse of the groundfish community in the earlier 1990s, the system was dominated by shellfish, with peak dominance in 2003 when more than 60 % of the estimated fall RV biomass was shellfish. However, groundfish components have been building up over the past several years, and shellfish is no longer the dominant functional group in terms of biomass.

The diet composition of a suite of predators in the region has been tracked since 2008. These studies indicate that predator diets have shifted in recent years with capelin becoming more important, and shrimp becoming less important in the diets. Capelin is an important prey for Atlantic Cod, Turbot and American Plaice, but also occurs in smaller amounts in Yellowtail Flounder and Redfish diets. The proportion of capelin in Turbot and American Plaice diets has been fairly consistent from 2008-14; Atlantic Cod relied more heavily on shrimp from 2008-12, but shifted to a capelin dominated diet in 2013-14.

Consumption by the total fish community was estimated using an array of different models and daily ration calculations. This approach rendered an order of magnitude envelope for food consumption by the entire fish community. These estimations, along with information on diet composition, were then used to estimate the envelope of annual predation on capelin. Predation on capelin has been increasing since the mid-2000s and in the last couple of years the estimated envelope of capelin consumed was 1-2.5 million tons per year. The increase in capelin consumption is related to both an increase in predator biomass and an increase of capelin in the diet of those predators. This increased consumption of capelin is likely to be playing a significant role in the rebuilding of the groundfish community.

**Discussion**

Many concerns were raised about the predator consumption model. The model is based on the fall survey and it is hard to assume that the same consumption would apply throughout the entire year. The dataset is not representative of the entire year and, therefore should not be multiplied by 365 days. It was explained that this is the first attempt to estimate the whole year, and it is the best we have at the time. Comments were made that the model should first be approached as consumption during the fall, with subsequent sensitivity analysis in order to demonstrate the stability of the model for this time of year, before being applied to the entire year. Missing from the model is the consumption of capelin by marine mammals and seabirds. Discussion of how this can aid in the estimated biomass of capelin ensued but no definite answers were available other than having an acoustic fall survey that then could be used to subtract the estimates consumption. Points were made overall that the consumption model is showing that predators are depending more on capelin, leading to the assumption that capelin must be increasing in the environment if the dependency on them by predators is increasing.

## CAPELIN FINAL DISCUSSION

Overall the industry and researchers agreed that for the next couple of years capelin look to be stable or increasing. Recruitment indices for the 2014 cohort are of a concern due to low larval values, although it was noted that this index only represented one major bay. While studies have suggested that this bay is likely to be a good index of overall production, there is a possibility that other bays around Newfoundland may have had average or good recruitment. It was also noted that there is some increased uncertainty surrounding the 2014 acoustic biomass estimate due to the fact that the survey did not cover all areas as in many of the previous years; although core strata were all covered.

## CAPELIN RECOMMENDATIONS

- Expand consumption estimates to look at seasonal aspects and include marine mammals (Harp seals), fish and seabirds in the model.
- The pelagic section should develop more expertise in reading capelin otoliths instead of relying on a single age reader.
- Implementation of the ice retreat model should be used as an additional diagnostic to evaluate the annual survey results.
- Implement a recruitment index model using a more statistical based model analysis to better quantify the increase of cohorts.
- Conduct a fall survey to accompany the spring survey and explore more beaches for recruitment and otolith microchemistry for capelin in the Gulf of St. Lawrence and Newfoundland stocks.
- Every effort should be made to present the potential value of the above information being collected, in particular for capelin and in general for forage species, in a timely manner.

## HERRING INTRODUCTION AND STOCK STRUCTURE

Presenter: C. Bourne

**Abstract**

Newfoundland Divisions 3KL and 3Ps herring stocks were last assessed in 2011 and an assessment framework meeting was held in 2013 where stock status was updated. There are five major stock complexes of herring on the northeast and south coasts of Newfoundland, two of which will have stock status updates: Bonavista Bay-Trinity Bay (BBTB) and Fortune Bay (FB), and two of which will be updated without a calculated stock status index: White Bay-Notre Dame Bay (WBNDB) and St. Mary's Bay-Placentia Bay (SMBPB). Within each stock there is both a spring and fall spawning component. Over the past decade the proportion of fall spawners in most stocks has increased from 10 % or less to as high as 90 % in some areas. It is suspected that this shift is tied to environmental conditions but analysis of potential drivers of recruitment is ongoing. The designation of spring and fall spawners was re-examined for this assessment and a potential set of rules was suggested for the designation of 'summer spawning' herring caught in July and August.

**Discussion**

A question was raised regarding how the spring and autumn spawning components are treated in other regions. In other areas, the two spawning components separate completely during some point in the year, giving a chance for researchers to quantify each spawning component. In Newfoundland, the spring and fall spawning components never separate completely making this a challenge to identify. Suggestions were made on how this identification of mixed stocks could be accomplished through maturation stage. At the moment priority is given to the otolith, the maturity, and the time of year the fish is caught, when assigning spawning component. Priority was suggested to be given to the development and use of a gonadosomatic index (GSI) index to determine the spawning time of the fish, which will then aid in classifying spring and autumn spawners.

## HERRING FISHERY AND INDUSTRY INPUT

Presenter: C. Bourne

**Abstract**

The combined TAC of herring in Divisions 3KL and subdivision 3Ps is 12,000 t and this has not been exceeded since the 1980s; 53 % of the combined TAC was landed in 2013. Landings data for 2014 are provided but considered preliminary for this assessment. Landings in WBNDB remained average in 2013 whereas BBTB saw the highest numbers since the early 1990s; the catch at age in both areas was similar, with a strong age 4 spring and age 5 fall cohort. Fall spawners accounted for over 60 % of the landings in both areas. There was a small purse seine fishery in SMBPB after several years with none, but landings were still relatively low and composed largely of age 11 + spring spawners. Landings in FB continue to decline and the catch at age is a concern, with over 80 % of the fish caught being age 11 + spring spawners. The 2013 purse seine survey indicated higher landings and fewer discards in most areas. Bait estimates obtained from the fixed gear telephone survey were lower than previous years in all areas except WBNDB. Fixed gear logbook returns remained low but daily catch rates obtained from some areas reflected trends observed in the research gillnet program. In the future, logbook mail-outs may be more targeted to obtain useful information on temporal trends.

**Discussion**

Concerns were raised regarding the amount of small fish being caught and released and there was some discussion about overfishing but it was stated this does not make sense because the older fish are surviving; the graphs depict recruitment failure. Discussion was raised about the logbooks and whether they are worth the effort as the return is very low. The attendees decided the logbooks were useful for areas where the gillnet survey is not available anymore. Also they are a great way to compare the gillnet survey to another source of data; thus far the data collected from the two agree with each other. The harvesters stated that the logbook returns would increase if made mandatory by active fishers. Discussion ensued regarding looking into the activity in the bar seine harvesting area in Fortune Bay. This could be addressed through the phone survey.

## DIET AND GROWTH OF LARVAL HERRING

Presenter: C. Currie

**Abstract**

Atlantic herring play an important role in the North Atlantic ecosystem by transferring energy from secondary producers to higher trophic levels. Newfoundland herring populations are composed of spring and fall spawners, targeted as a mixed fishery. In the past, spring spawners accounted for ~90 % of the total catch. Within the last decade, spring spawners have substantially decreased, while fall spawners slightly increased, now dominating the catch. Peak production of copepods species such as *Pseudocalanus sp.* and *Calanus finmarchicus* has simultaneously shifted from spring to fall. These copepods are known to play an important role in the diet of several species of larval fishes. We test the hypothesis that the shift in herring abundance is related to larval feeding success and survival. Larval samples were collected using bongo tows in Trinity Bay, Newfoundland, between 2002 and 2013. We also relate the time series of diet composition to a zooplankton time series (1999-2013) to examine if changes in the timing of preferred prey production correspond to those in the dynamics of the herring stock. Otolith microstructure is explored to relate recent and overall growth to the available prey. This study will provide information on how prey availability contributes to the early survival of Atlantic herring.

**Discussion**

Points were raised on how to explore the larval data collected. Explore temperature and how it might be effecting larval growth in different years and the spatial distribution of larvae that were analyzed to determine if there is an area effect. Discussion was also raised about the unique timing of the autumn zooplankton peak; the explanation for why there is now a large peak in the fall is still unknown.

## BIOLOGICAL AND ECOLOGICAL HERRING DATA

Presenter: C. Bourne

**Abstract**

Spring spawning times were examined using results from the long running research gillnet program. The onset of spawning was difficult to determine in the 2000s after an abrupt shift in timing, but appears to be later than in the past, with peak spawning potentially occurring in July in many areas. The length of herring at 50 % maturity (L50) was examined to help address issues with small fish in the purse seine fishery. The L50 of spring year classes declined

through the 1980s to the mid-1990s, but increased through the 2000s – the same analysis could not be done for fall spawners due to small sample sizes. The weight and length at age of both spring and fall spawners decreased in the 1990s in all areas, and decreased further in the 2000s in SMBPB and FB. The mean somatic condition of both spring and fall spawners decreased in the 2000s and again in the 2010s. The number of herring caught in spring offshore multispecies surveys increased during the 2000s, with distribution concentrated along the south coast (3Ps). The age distribution of samples collected offshore reflects that of the commercial and research gillnet fishery in most areas.

**Discussion**

Discussion and concerns were raised about unknown migration patterns of herring. For example in BBTB herring are now being seen more in August when the Salmon fishery takes place and are seen in the bay in January when they historically moved out during the winter. Migration movements need to be explored in order to understand the herring stocks and where the adults go throughout the year. Concern was also raised about Newfoundland herring mixing with the Gulf of St. Lawrence stocks, once again suggesting exploration of the migration patterns, which are not known at this time. Harvesters inquired if the L50 (the value used to set the minimum size limit in the commercial fishery), will stay the same as it was for the pilot project (9.5 inches) or go back to 10 inches. There are a lot of small fish out there but keeping the L50 lowered may harm the recruitment of adults into the population for future years and therefore they advised against this going forward. Questions were asked in regard to more herring being caught offshore and to which stock do these fish belong. There is currently a genetic study ongoing and possibly analysis of otolith microstructure that will aid in answering these questions; however, at this time it is unknown to which stock the offshore fish belong.

## HERRING ABUNDANCE AND STOCK STATUS

Presenter: C. Bourne

**Abstract**

The research gillnet program provides an age-disaggregated, fishery-independent index of abundance for BBTB and FB. In BBTB the 2013 catch rates were average with fall spawners once again comprising more than 50 % of the catch, and the age distribution continued to be largely composed of the 2009 spring cohort and 2008 fall cohort. Catch rates in 2014 were above average. In FB spring spawners continue to comprise the majority of the catch. Catch rates in this area have been at their lowest in the time series for the past 4 years and the age distribution is composed of over 75 % age 11 + spring spawners, which is a concern. This index will be used to update the stock status for these areas during the assessment meeting. With no research gillnet abundance index, a stock update will be provided for WBNDB and SMBPB based on the information presented at this meeting, potentially including trends observed in neighboring stock areas for which stock status has been calculated.

**Discussion**

Inquiries were made of the gillnet survey catchability success and whether the whole picture is being captured. Within the gillnet survey fleets of nets are set close together at the same location each year which should be capturing the whole picture of each bay in which the survey is being conducted. Although the harvesters originally picked the location of where to set the gillnet and there is no concrete evidence to know if the net is placed in the same place every year, it was recommended to record the location of each fleet and where the net is set in future surveys.

There was a discussion on the weighted importance of the three indices used to determine stock status: cohorts above average, mean catch rate of older fish, and research gillnet catch rates. Each index relates to each other to some extent therefore there is no reason to rate one more than the other, therefore, weigh all equally.

Points were raised on why an acoustic survey could not be conducted; this was done in the past but detectability was low. Possibly with new technologies this would work now, although the gillnet survey did compare to the acoustics making the gillnet survey a comparable method, but it does not give a biomass estimate. Concern was raised that the gillnet survey catch rates might be higher than the actual abundance. This should be explored in further detail but is not thought to be the case by researchers at this time.

## HERRING FINAL DISCUSSION

Overall the science is lacking due to reductions in the acoustic survey in the past, and recent reductions to the gillnet survey in bays that are still being harvested. These survey changes lead to more uncertainty in the assessment. More knowledge, in particular in abundance estimates and migration patterns, would allow more accurate decisions to be made in the future.

## HERRING RECOMMENDATIONS

- Reinstate the acoustic survey to get an estimation of biomass and reinstate gillnet survey in SMBPB and WBNDB.
- Implement a stock complex migration study, investigate most appropriate method to obtain information on migration patterns.
- Develop a GSI to identify spring and autumn stock spawning components.
- Instate an exploratory quota for the month of August to gain scientific and fishery knowledge for this month.
- Investigate the potential impact of the net positioning in the research gillnet survey on catch rates for different areas.
- Fix the reference period number when calculating the averages for each stock areas catch.
- Provide updates for Conception Bay and Southern Shore (CBSS).
- Conduct phone survey for bar seine fishery in FB.
- Consider methods to increase the return of logbooks which will supplement stock status information in the areas where there is no research gillnet program.

## REFERENCES CITED

DFO. 2013. Assessment of Capelin in SA2 + Div. 3KL in 2013. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2013/011.

Nakashima, B.S. 1996. The relationship between oceanographic conditions in the 1990s and changes in spawning behaviour, growth and early life history of Capelin (*Mallotus villosus*). NAFO Sci. Coun. Stud. 24: 55-68.

## APPENDIX I

**Terms of Reference: Capelin**

**Status of Subarea 2 and Division 3KL Capelin**

**Regional Peer Review, Newfoundland and Labrador Region**

**February 3-5, 2015**
**St. John's NL**

Chairperson: Rick Rideout, Aquatic Resources Division, Science Branch, DFO, NL Region

### Context

The status of capelin in Subarea 2 + Div. 3KL was last assessed in 2013. The current assessment is requested by Fisheries and Aquaculture Management to provide the Minister with detailed advice on the status of this stock.

### Objectives

A review of available information concerning the status of Subarea 2 + Div. 3KL capelin as follows:

- Information on historical catches up to and including the 2014 fishery.
- Trends in abundance from the spring acoustic survey and larval recruitment indices.
- Behavioural information on occurrence, distribution, and spawning times.
- Biological information on sizes, ages and maturities.
- Review of capelin feeding and condition
- Recent changes in predator field
- Evaluation of projection methods for larval recruitment index

### Expected Publications

- Science Advisory Report
- Proceedings
- 2 Research Documents

### Participation

- DFO Science, Newfoundland and Labrador and Maritimes Regions
- DFO Fisheries and Aquaculture Management, Newfoundland and Labrador Region
- Industry Representatives
- Aboriginal Groups
- Non-Governmental Organizations
- Fish, Food and Allied Workers Representatives
- Provincial Department of Fisheries and Aquaculture
- Memorial University of Newfoundland

## APPENDIX II

**Terms of Reference: Herring**

**Status of Division 3KL and Subdivision 3Ps Herring**

**Regional Peer Review, Newfoundland and Labrador Region**

**February 3-5, 2015**
**St. John's NL**

Chairperson: Rick Rideout, Aquatic Resources Division, Science Branch, DFO, NL Region

### Context

The status of herring in Div. 3KL and Subdivision 3Ps was last assessed during a herring framework meeting in 2013. The current assessment was requested by Fisheries and Aquaculture Management to provide the Minister with detailed advice on the status of these stocks.

### Objectives

A review of any new information concerning the status of East and South Newfoundland Herring in the following stock areas:

- White Bay – Notre Dame Bay
- Bonavista Bay – Trinity Bay
- St. Mary's Bay – Placentia Bay
- Fortune Bay

The meeting will focus on the general state of herring stocks in Newfoundland and Labrador and identify any conservation issues requiring adjustments to the management plan.

The following topics will be discussed:

- Description of the 2013 and 2014 Commercial Fisheries (to date)
- Results of the Herring Research Gill Net Program for 2013-2014 in Bonavista-Bay Trinity Bay and Fortune Bay
- Results from Herring Commercial Fixed Gear Logbooks for 2013-2014
- Results of the Herring Purse Seine Questionnaires for 2013-2014
- Results of the Herring Telephone Questionnaire 2014
- Results of the Cumulative Change in Abundance Index 2013-2014
- Examination of Biological and Ecological Data for 2013, including a discussion of the length at maturity and implications for size limits in the fishery
- Examination of the Biology and Distribution of Herring caught in spring offshore surveys from 2011-2014
- Examination of Trends and potential changes in Spawning Stock Composition and Spawning Type Designation

### Expected Publications

- Science Advisory Report
- Proceedings
- Research Document

**Participation**

- DFO Science, Newfoundland and Labrador and Maritimes Regions
- DFO Fisheries and Aquaculture Management, Newfoundland and Labrador Region
- Industry Representatives
- Aboriginal Groups
- Non-Governmental Organizations
- Fish, Food and Allied Workers Representatives
- Provincial Department of Fisheries and Aquaculture
- Academia

## APPENDIX III

**Agenda: Status of Subarea 2 and Divisions 3KL Capelin and**

**Status of Divisions 3KL and Subdivision 3Ps Herring**

**Hampton Inn & Suites, St. John's, NL**

**February 3-5, 2015**

**Chairperson: Rick Rideout**

**Tuesday, February 3**

| Time | Overview | Presenter |
|---|---|---|
| 9:00 – 9:15 | Introduction | R. Rideout (Chair) |
| 9:15 – 9:45 | Environmental Overview | Maillet/ Colbourne |
| 9:45 – 10:15 | Distribution Information<br>Acoustic surveys<br>Bottom trawl surveys<br>Shrimp by-catch | F. Mowbray |
| 10:15 – 10:30 | *Refreshment Break* | *N/A* |
| 10:30 – 11:00 | Fishery<br>• Landings, catch characteristics | F. Mowbray |
| 11:00 – 11:30 | Biological Information<br>• Distribution<br>• Spawning times<br>• Size and age structure: Spring acoustic survey<br>• Maturation, condition | F. Mowbray |
| 11:30 – 12:00 | Opportunistic acoustic data collections from the Fall Multi-species trawl survey | F. Mowbray and Paul Regular |
| 12:00 – 1:00 | *Lunch (Not Provided)* | *N/A* |
| 1:00 – 1:30 | Abundance<br>• Div. 3L Spring acoustic survey | F. Mowbray and P. Regular |
| 1:30 – 2:15 | Recruitment<br>• Bellevue Beach<br>• Trinity Bay<br>• Acoustic survey<br>• Comparison of indices | F. Mowbray and P. Regular |
| 2:15 – 2:45 | Capelin predators and consumption | N. Wells |
| 2:45 – 3:00 | *Refreshment Break* | *N/A* |
| 3:00 – 3:30 | Capelin spring and autumn diets | F. Mowbray and D. Kamada |
| 3:30 – 4:00 | Capelin - Seabird Interactions | TBD |

**Wednesday, February 4**

| Time | Overview | Presenter |
|---|---|---|
| 9:00 – 10:00 | Unfinished Discussions / Additional Items<br>• Sources of uncertainty<br>• Stakeholders perspectives | R. Rideout (Chair) /<br>F. Mowbray |
| 10:00 – 10:30 | Research Recommendations, Conclusions and Advice | F. Mowbray |
| 10:30 – 10:45 | *Refreshment Break* | *N/A* |
| 10:45 – 12:00 | Drafting of SAR Summary Bullets | F. Mowbray |
| 12:00 – 1:00 | *Lunch (Not Provided)* | |
| 1:00 – 1:30 | Introduction (Herring Assessment) | C. Bourne |
| 1:30 – 2:45 | Commercial Fishery:<br>• Landings, catch at age, industry input | C. Bourne |
| 2:45 – 3:00 | *Refreshment Break* | *N/A* |
| 3:00 – 4:00 | Biological and Ecological Data | C. Bourne |
| 4:00 – 4:30 | Larval herring diet - implications on population dynamics | C. Currie |

**Thursday, February 5**

| Time | Overview | Presenter |
|---|---|---|
| 9:00 – 10:15 | Herring Assessment<br>• Abundance index, Stock Status | C. Bourne |
| 10:15 – 10:30 | *Refreshment Break* | *N/A* |
| 10:30 – 11:00 | Research Recommendations, Conclusions and Advice | C. Bourne |
| 11:00 – 12:00 | Drafting of SAR Summary Bullets | F. Mowbray |
| 12:00 – 1:00 | *Lunch (Not Provided)* | *N/A* |
| 1:00 – 4:30 | Additional Items/ Time *(if necessary)* | - |

## APPENDIX IV

### List of Attendees: Herring and Capelin Peer Review Meeting

### Feb. 3-5, 2015

### Hampton Inn & Suites

| Name | Affiliation |
|---|---|
| Rick Rideout | DFO Science, NL Region |
| James Meade | DFO Science, NL Region, CSA Office |
| Brad Squires | DFO Science, NL Region |
| Craig Purchase | MUN |
| Jason Croft | DFO Science, NL Region |
| Alejandro Buren | DFO Science, NL Region |
| Carissa Currie | CFER-MI |
| Ian McQuinn | DFO Science, Quebec Region |
| Sherrylynn Rowe | CFER-MI |
| Dominique Robert | CFER-MI |
| Erin Dunne | DFO RM |
| Kevin Hurley | DFO RM |
| Robbie Green | Fish Harvester |
| Gilbert Penney | Fish Harvester |
| George Feltham | Fish Harvester |
| John Boland | FFAW |
| Erin Carruthers | FFAW |
| Christina Bourne | DFO Science, NL Region |
| Derek Butler | ASP |
| Nancy Pond | DFA |
| Karl Sullivan | Barry Group |
| Fran Mowbray | DFO Science, NL Region |
| Frank Dawson | DFO Science, NL Region |
| Paul Regular | DFO Science, NL Region |
| Nadine Wells | DFO Science, NL Region |
| Peter Shelton | DFO Science, NL Region |
| Paula Lundrigan | DFO Science, NL Region |
| Laurie Hawkins | DFO RM |
| Wayne King | DFO RM |
| John Brattey | DFO Science, NL Region |
| Luis Mello | DFO Science, NL Region |
| Gary Maillet | DFO Science, NL Region |
| Timothee Govare | CFER(MI) |
| Diago Kamada | CFER(MI) |
| Barry Slaney | DFO Science, NL Region |
| Don Power | DFO Science, NL Region |
| Jason Simms | DFO RM |
| Julie Diamond | DFO Strategic Services |